8087 NUMERIC DATA COPROCESSOR

Z-100 PC SERIES COMPUTERS USER'S INSTALLATION MANUAL

8087 Numeric Data Coprocessor

Z-100 PC Series Computers

User's Installation Manual

ZENITH | data
systems

Contents

Introduction

The 8087 Numeric Data Coprocessor, with the proper software, can take over some of the arithmetic processing from the 8088 microprocessor and speed up the calculating of certain kinds of data. These instructions show you how to install the 8087 in your Z-100 PC Series Computer.

CAUTION: The 8087 coprocessor is an electrostatic-sensitive device and may be damaged by static electricity. **DO NOT** remove this integrated circuit (IC) from the protective foam pad until you are ready to install it.

Parts List

PART NO.	QUANTITY	DESCRIPTION
443-1168	1	8087 Numeric Data Coprocessor
595-3270	1	8087 Numeric Data Coprocessor Installation Manual

For disassembly, you will need a small Phillips screwdriver.

If you are installing the 8087 coprocessor in a Z-150 PC Series Computer, installation instructions begin in Cover Removal (Z-150 Series).

If you are installing the 8087 coprocessor in a Z-160 PC Series Computer, installation instructions begin under Cover Removal (Z- 160 Series).

Disassembly

Cover Removal (Z-150 Series)

See Figure 1.

☐ Turn off the unit and unplug the line cord from the AC outlet.

☐ If a monitor is connected to your computer, disconnect the monitor and set it aside.

☐ Remove and save the seven screws at location A.

☐ Lift the rear of the top cover slightly; move it to the rear until the front clears the front panel of your computer.

☐ Lift the top cover straight up and set it to one side.
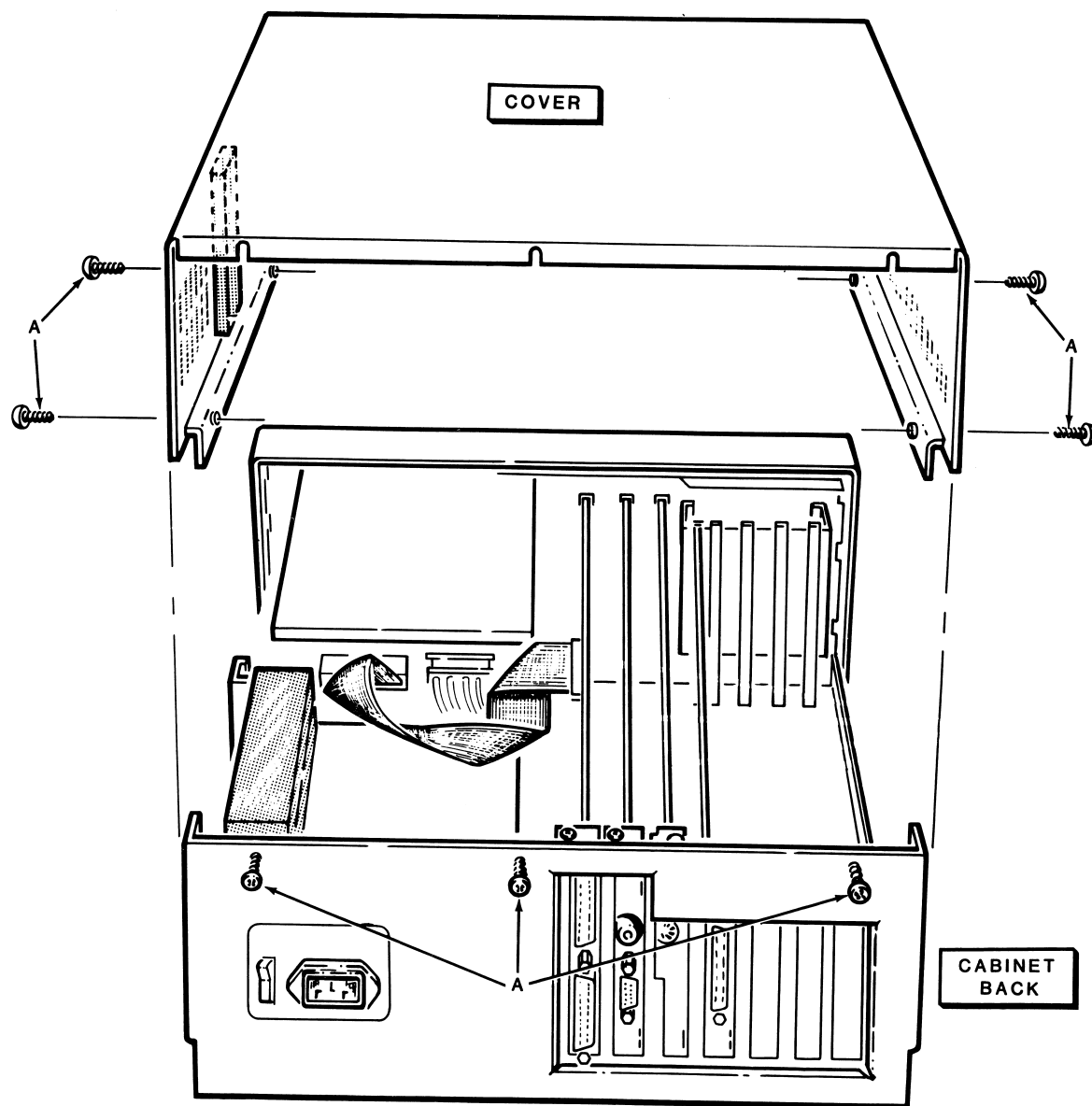
☐ Proceed to CPU Card Removal section.

COVER

A

A

A

A

CABINET
BACK

Figure 1.   Cover Removal (Z-150 Series)

Cover Removal (Z-160 Series)

WARNING: Even with the computer turned off and the line cord removed from the AC outlet, hazardous voltages may be present inside your computer. Do not touch anything in the area of the CRT.

See Figure 2.

☐ Turn off the unit and unplug the line cord from the AC outlet.

☐ Press and hold the drive assembly latches to the front. Swing the front of the drive assembly until it is vertical. Hold or prop it in this position.
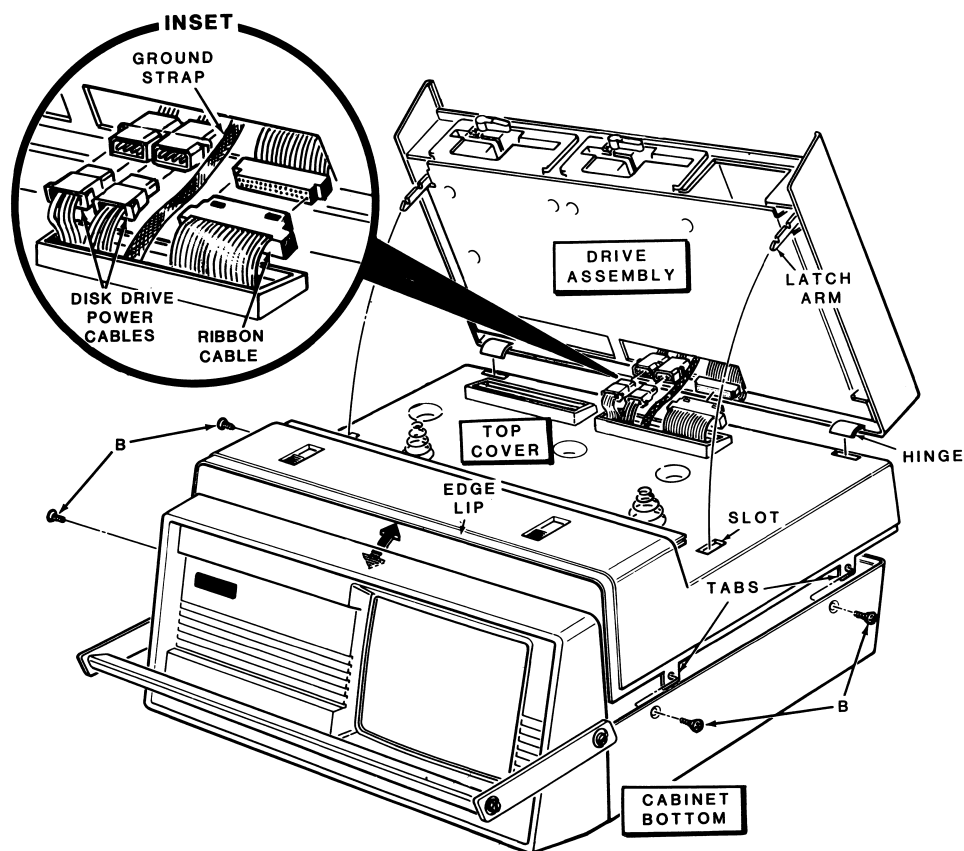

Figure 2. Cover Removal (Z-160 Series)

☐ Disconnect the ground strap and the disk drive power cable(s). See inset on Figure 2.

☐ Lift the drive assembly straight up, off the computer, and carefully place it to one side.

☐ Remove and save the four screws at location B.

☐ Lift the rear of the top cover slightly; move it to the rear until the front clears the front panel of your computer.

☐ Lift the top cover straight up and set it to one side.

See Figure 3.

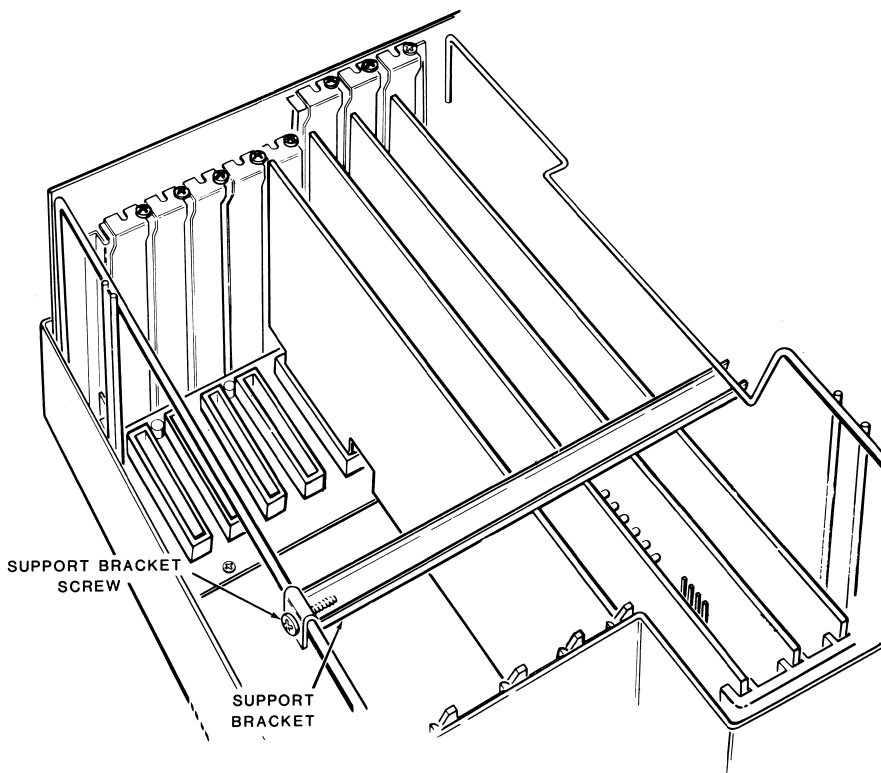☐ Remove and save the support bracket screw. Remove the support bracket and set it to one side.

Figure 3. Support Bracket

CPU Card Removal

See Figure 4.

☐ Place your computer so the front is facing you.

☐ Locate the CPU card, which will be the third card from the right. The CPU card will have the speaker cable connected to it.

☐ Carefully disconnect the speaker cable from the CPU card.

☐ Remove and save the screw which secures the CPU support bracket to the back of the computer cabinet.

☐ Firmly grasp the CPU card to be removed with one hand at the back and the other hand about midway down the card. Carefully pull the card straight up. Do not jerk the card. You will be able to feel the card releasing from the edge connector.

NOTE: If your computer includes a catch at the top of the card guide, the catch must be pulled to the side to allow the removal of the card.

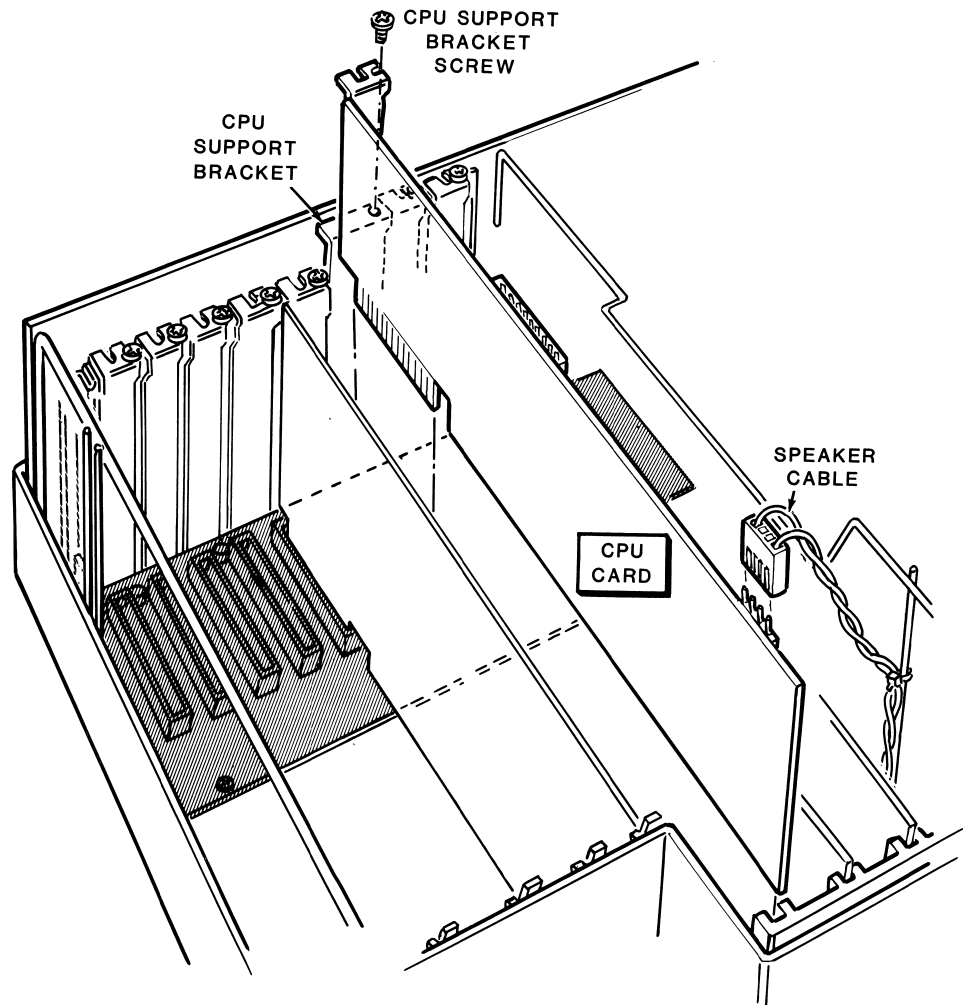☐ Place the card on a flat surface with the components facing up.

CPU SUPPORT
BRACKET
SCREW

CPU
SUPPORT
BRACKET

SPEAKER
CABLE

CPU
CARD

Figure 4.   Card Removal

Installation

8087 Installation

CAUTION: The 8087 coprocessor is an electrostatic-sensitive device and may be damaged by static electricity. Please use extreme care not to create static electricity when handling this device.

See Figure 5.

☐ Pick up the protective foam pad which contains the IC with one hand and remove the IC with the other.

☐ Continue to hold the IC with one hand and straighten any bent pins with the other hand.

☐ Be sure the pins are at right angles with the body of the IC. If not, lay the IC down on one of its rows of pins, as shown in Figure 5, and roll it until the pins are at right angles. Repeat this process for the other row of pins.
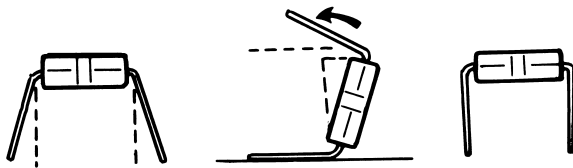
Figure 5. Rolling to Bend Pins

See Figure 6.

☐ Align pin 1 end of the IC with the index mark on the CPU card.

☐ Carefully push the IC into the socket. Once the IC is in the socket, it is protected from static electricity.

CAUTION: A pin can become bent under the IC and will appear to be correctly seated in its pocket. If a malfunction occurs while testing, examine the IC (and remove it, if necessary) to be certain that all pins are completely inserted.
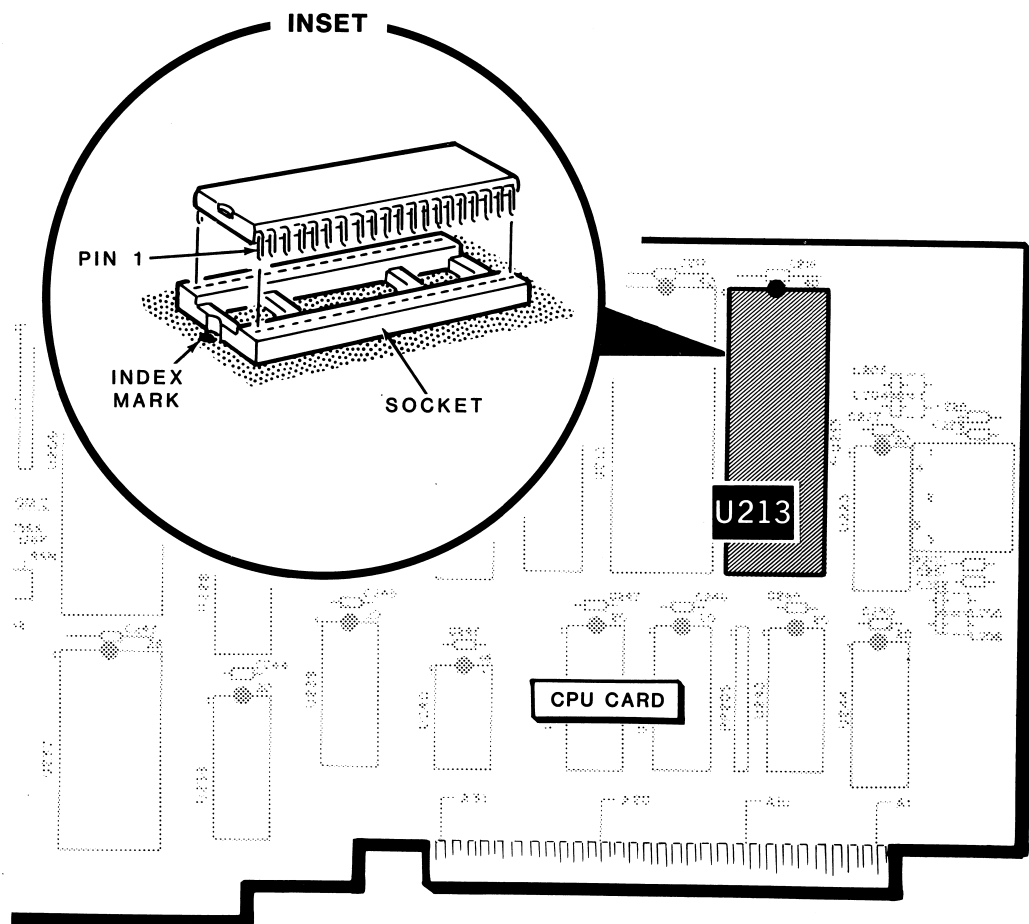
Figure 6.   Location and Alignment of the 8087 Numeric Data Coprocessor

Resetting DIP Switch SW1

See Figure 7.

There are two Dual Inline Package (DIP) switches on the CPU card. These switches are set to reflect the current hardware configuration of your Z-100 PC Series Computer. When you add the 8087 coprocessor, the DIP switch, SW1, **must** be reset.

☐ Locate SW1 at the left hand side of the CPU card.

☐ With a small tool, move the switch in section 1 of SW1 from right to left to show the existence of the 8087 coprocessor. See the inset in Figure 7.
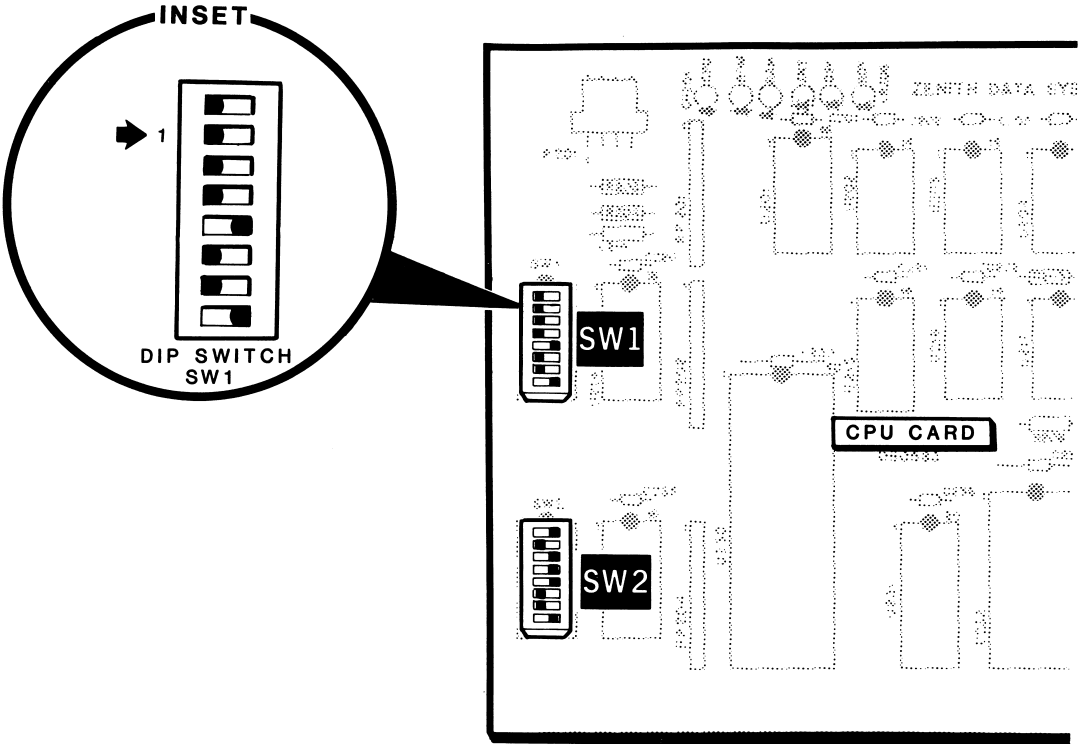
Figure 7.   Location and Configuration of SW1

CPU Card Replacement

See Figure 8.

☐ Position the card over the backplane. Notice the grooves at the ends of the cabinet. Be sure that the edges of the card align with the grooves.

☐ Align the edge connector with the socket in the backplane. Slowly and firmly slide the edge connector into the socket.

☐ Replace the screw which secures the CPU support bracket.

☐ Replace the speaker cable.
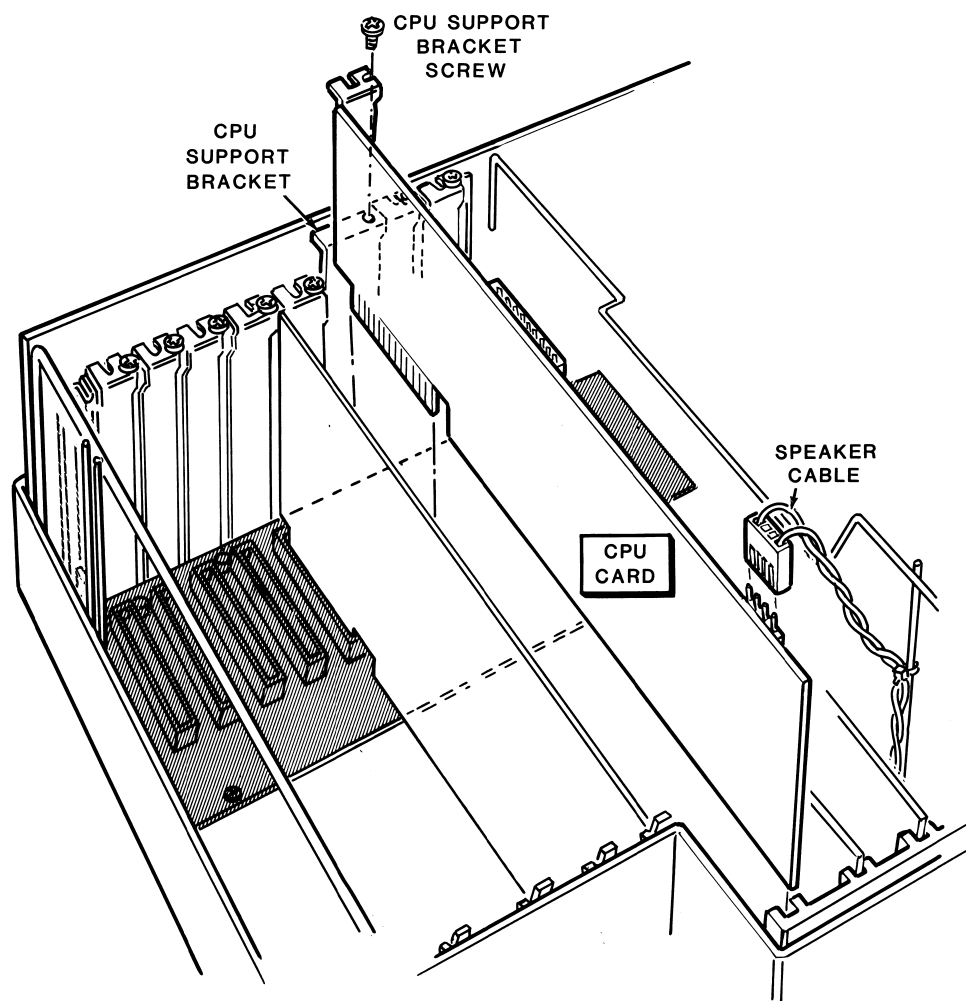
Figure 8.   Card Replacement

Reassembly

Cover Replacement (Z-150 Series)

See Figure 9.

☐ Before replacing the cover, make sure that all internal components are in place.

☐ Slide the front of the top cover under the lip of the front panel and then lower the cover onto the computer. Replace the seven screws in location A and tighten them.

COVER

A

A

A

A

CABINET
BACK

A

Figure 9. Cover Replacement (Z-150 Series)

Cover Replacement (Z-160 Series)

See Figure 10.

☐ Before replacing the cover, make sure that all internal components are in place.

☐ Replace the support bracket with the support bracket screw as shown in Figure 10.

☐ Pick up the top cover and push the ribbon cable and the disk drive power cable(s) through the slots in the top cover.

SUPPORT BRACKET
SCREW
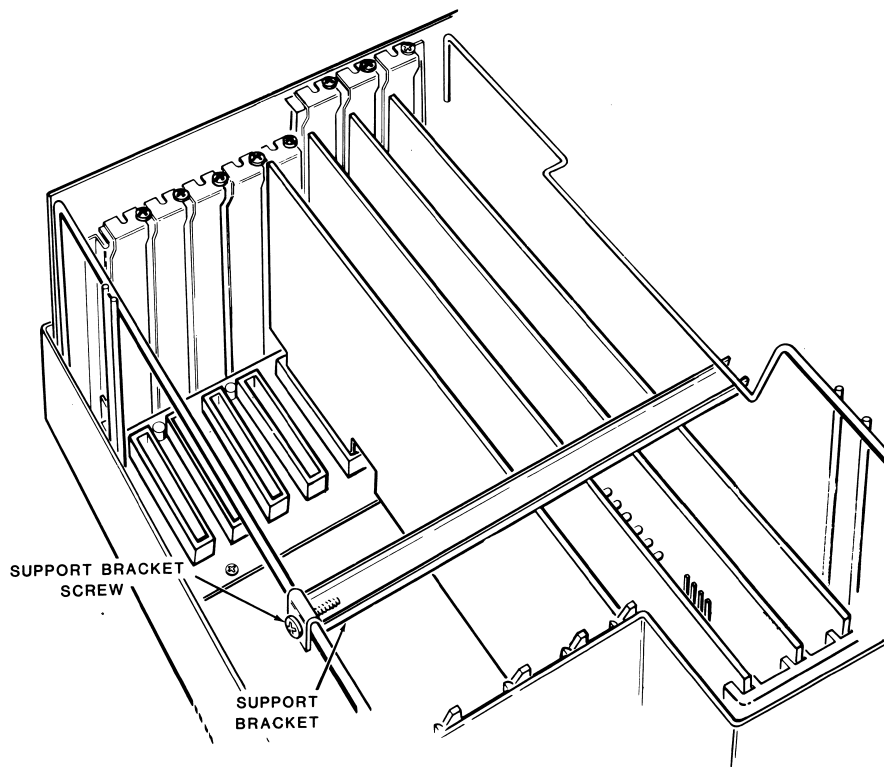
SUPPORT
BRACKET

Figure 10.   Support Bracket

See Figure 11.

☐ Slide the front of the top cover under the lip of the front panel and then lower the cover onto the computer. Replace the four screws in location B and tighten them.
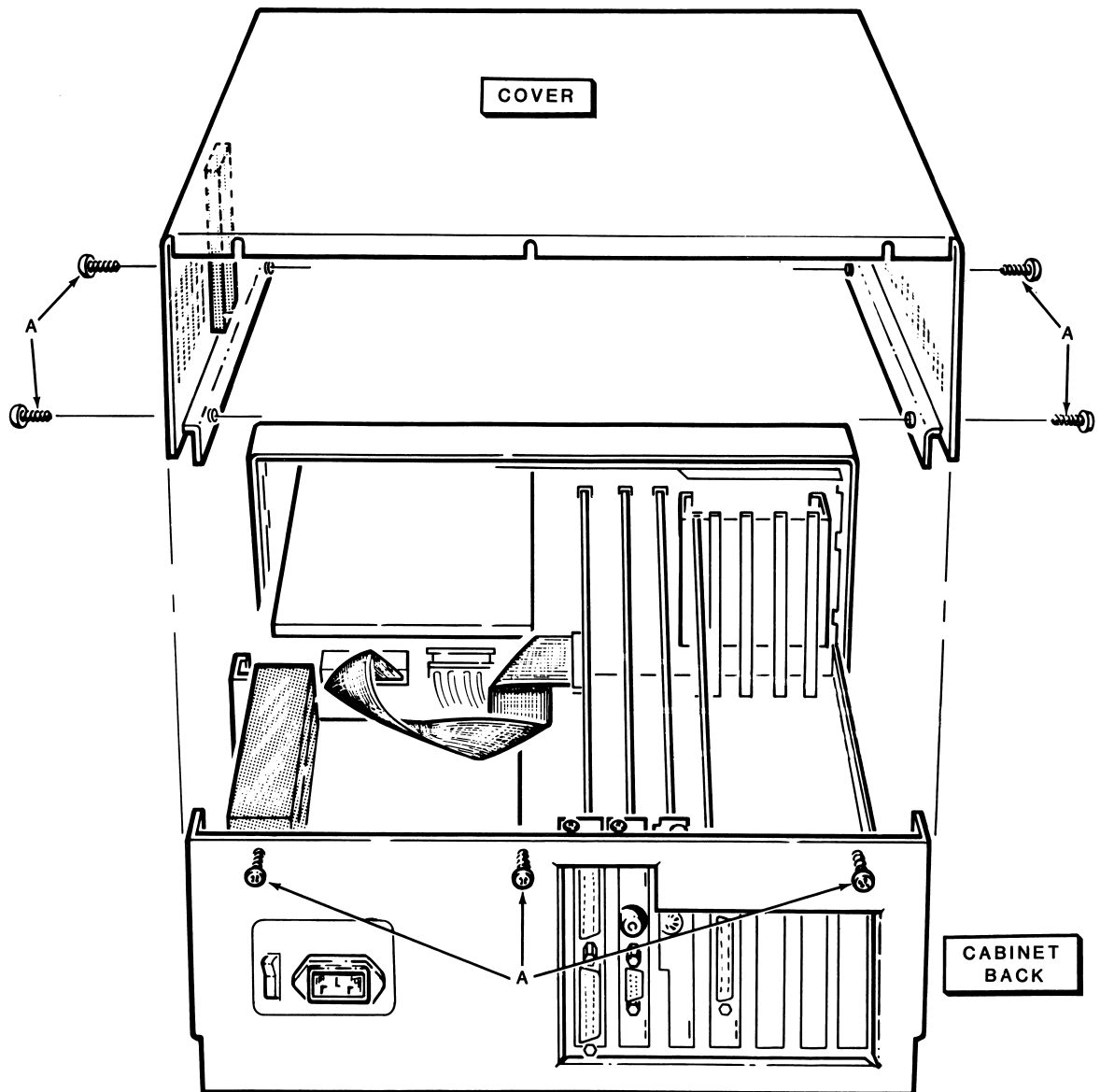
☐ Lift the drive assembly into position and engage the hinges into the slots of the top cover. Hold or prop the drive assembly vertical.

☐ Reconnect the ribbon cable and the disk drive power cable(s) to the drive assembly.

☐ Reconnect the ground strap.

☐ Gently lower the drive assembly into position and engage the latch arms into their respective slots on the top cover.
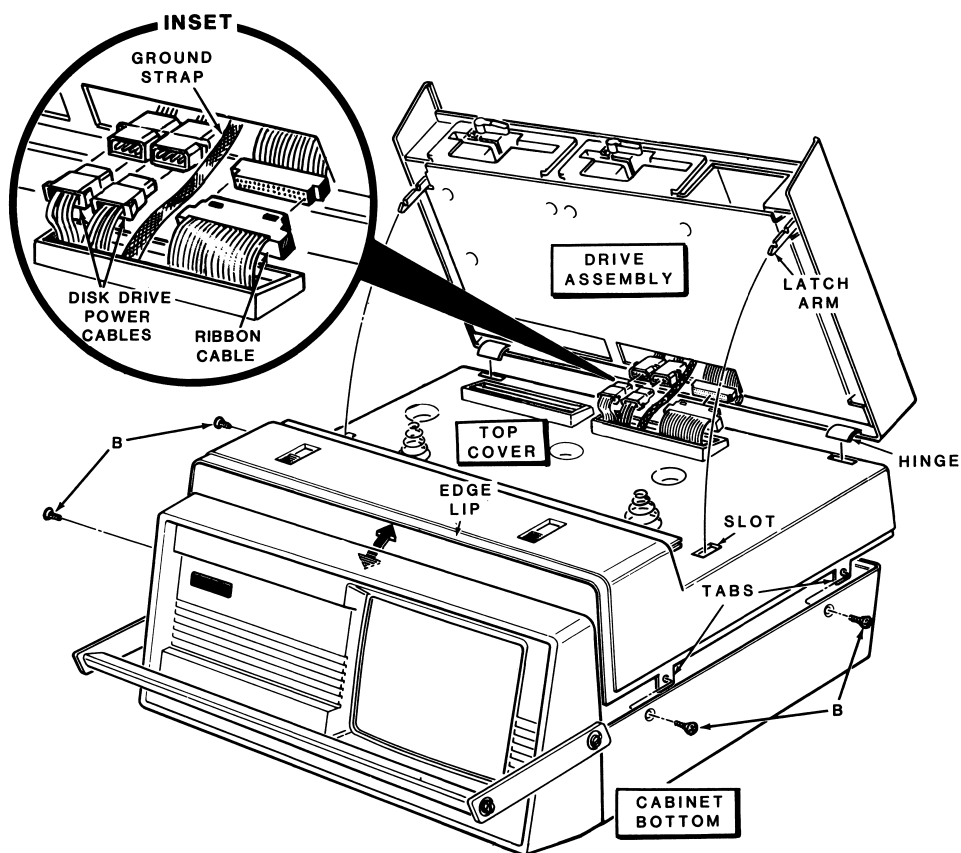
Figure 11.   Cover Replacement (Z-160 Series)

Initial Test

The following BASIC routine will test the 8087 coprocessor. Successful completion of the test indicates a properly installed and functioning 8087.

To execute the test, type in the following BASIC program and run it.

```
10 REM   Test the 8087 Coprocessor
20 DEFINT A-Z
30 REM   Set up integer array A() to hold machine language code
40 DIM A(43)
50 REM   Read machine language code into array A()
60 FOR C=1 TO 86 STEP 2
70 READ A,B
80 E=E+A+B
90 A$=CHR$(A)+CHR$(B)
100 D=INT(C/2)
110 A(D)=CVI(A$)
120 NEXT C
130 REM   Sumcheck test of code read
140 IF E<>6830 THEN PRINT "There is an error in your data statements.";  : END
150 REM   Get beginning address of array A()
160 FUNC = VARPTR(A(0))+4
170 REM   Set the variable and call the function
180 A% = 5
190 CALL FUNC(A%,B%)
200 REM   Print the original value and the result
210 IF A%=B% THEN PRINT "The 8087 is correctly installed and functioning." : END
220 IF A%+1=B% THEN PRINT "The 8087 is not installed or is non-functional." : END
230 PRINT A%;B%;" There is an error condition in the test." : END
240 REM   The following data statements hold the machine language code
250 DATA 1, 0, 0, 0, 0, 0, 0, 0, 139, 236
260 DATA 139, 118, 6, 139, 4, 46, 163, 2, 0, 139
270 DATA 126, 4, 46, 137, 62, 4, 0, 219, 227, 232
280 DATA 46, 0, 217, 238, 232, 41, 0, 223, 22, 0
290 DATA 0, 232, 34, 0, 186, 0, 0, 46, 131, 62
300 DATA 0, 0, 0, 116, 4, 66, 235, 4, 144, 186
310 DATA 0, 0, 46, 161, 2, 0, 3, 194, 46, 139
320 DATA 62, 4, 0, 137, 5, 202, 4, 0, 185, 100
330 DATA 0, 3, 210, 226, 252, 195
```

Since it is possible to make a typographical error in entering the previous program, we have provided this section to help you debug and understand the operation of the program. Use the following troubleshooting chart to help you debug the test program or fix the problems indicated by the messages shown.

MESSAGE OR SYMPTOM	POSSIBLE CAUSE	POSSIBLE REMEDIES
Program runs but locks up; no message.	Bad code in two or more data statements.	Closely check each number in the data statements.
The 8087 is correctly installed and functioning.	No problem, 8087 functioning properly.	
The 8087 is not installed or is non-functional.	Installed incorrectly.	1. Check CPU Switch. 2. Check 8087 IC for: orientation (pin 1 not in proper position), or bent pins (not fully inserted).
	8087 failure.	Refer to your Zenith Data Systems dealer.
There is an error condition in the test.	Error in data statements.	Check data statements in test program.
There is an error in your data statements.	Error in data statements.	Check data statements in test program.
Out of DATA in 70	Error in data statements.	Check data statements in test program.

The machine language code used in the BASIC program was obtained
from the following assembly language program:

```
1                           page    ,132
2
3    = 0000                 ZERO     equ    0
4    = 0001                 ONE      equ    1
5
6    0000                   prog     segment
7                                    assume  cs:prog
8    0000  0001             test_word          dw      ONE      ; At start of routine, this is 1
9    0002  ????             msi                dw?
10   0004  ????             mdi                dw?
11   0006  ????             msp                dw?
12
13   0008                   start:
14   0008                   func     proc   far
15   0008  8B EC                     mov     bp,sp              ; Set the BP reg equal to SP
16   000A  8B 76 06                  mov     si,[bp+6]          ; Get address of first integer
17   000D  8B 04                     mov     ax,word ptr [si]       ; put value into ax register
18   000F  2E: A3 0002 R             mov     msi,ax             ; Store value in memory
19   0013  8B 7E 04                  mov     di,[bp+4]          ; Get address of second integer
20   0016  2E: 89 3E 0004 R          mov     mdi,di             ; put address into memory
21   001B  DB E3                     db      0DBH, 0E3H         ; Imitate a 'finit'
22   001D  E8 004E R                 call    delay              ; Perform a timeout
23   0020  D9 EE                     db      0D9H, 0EEH         ; Imitate a 'fldz'
24   0022  E8 004E R                 call    delay              ; Perform a timeout
25   0025  DF 16                     db      0DFH, 016H         ; Imitate a 'fist'
26   0027  0000 R                    dw      offset word ptr test_word
27   0029  E8 004E R                 call    delay              ; Perform a timeout
28   002C  BA 0000                   mov     dx, 00H            ; clear dx register
29   002F  2E: 83 3E 0000 R 00       cmp     test_word, 0H      ; If word is a zero
30   0035  74 04                     jz      present_8087       ; go report that fact
31   0037  42                        inc     dx                 ; increment dx if 8087 not present
32   0038  EB 04 90                  jmp     done
33   003B                   present_8087:
34   003B  BA 0000                   mov     dx, 00H            ; set dx to 0
35   003E                   done:
36   003E  2E: A1 0002 R             mov     ax,msi             ; Retrieve the first integer
37   0042  03 C2                     add     ax,dx              ; Add dx to ax (first integer)
38   0044  2E: 8B 3E 0004 R          mov     di,mdi             ; Move address back into di
39   0049  89 05                     mov     word ptr [di],ax       ; Store the result back
40   004B  CA 0004                   ret     4                  ; Clear the parameters and return to
41   004E                   func     endp                       ; Z-BASIC
42
43   004E                   delay    proc   near
44   004E  B9 0064                   mov     cx, 100
45   0051                   repeat:
46   0051  03 D2                     add     dx,dx
47   0053  E2 FC                     loop    repeat
48   0055  C3                        ret
49   0056                   delay    endp
50
51   0056                   prog     ends
52                                   end
```